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Tipularia
A BOTANICAL MAGAZINE

Published by the Georgia Botanical Society 1999

Watercolor painting by Gail Arnott Carr

***Pogonia ophioglossoides*, rose pogonia**

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Authors and Artists

Gail Arnott Carr holds a Bachelor of Fine Arts degree in Painting and Sculpture from Carnegie-Mellon University. She has worked for many years as an artist and designer. A strong interest in nature and the environment has led Gail to her current activities in botany and painting. She hopes to use her paintings to educate the public about the critical plight of our natural treasures.

Carol Howel Gomez received her Master's Degree in plant taxonomy from the University of Georgia, for which she conducted a floristic survey of High Falls and Indian Springs State Parks. In 1992, an article based on this work was published in Tipularia. Carol has been a part-time herbarium consultant for Rabun Gap-Nacoochee School since 1991 and is currently working on a flora of New Echota Historic Site in Gordon County, Georgia.

Carol Nourse, M.S., has been photographing the State Botanical Garden of Georgia in all seasons and weathers since 1990. She and her husband, Hugh, have donated many of their slides to the Garden for use in publications and slide presentations and were named Volunteers of the Year by the Garden in 1997. Their book, Wildflowers of Georgia: a Celebration of Their Beauty and Diversity, is scheduled for publication by UGA Press in the spring of 2000.

Elaine Hearn Rabon is a longtime resident of Athens, Georgia. She currently works as a floral designer and free-lance artist and enjoys sketching our native flora and fauna. She is familiar with the area of northeast Georgia where the Oconee bells grow, as her family enjoys hiking and fishing there.

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Membership

The Georgia Botanical Society is open to all persons interested in the botany of Georgia. Annual dues: individual or family, $20; group, $25; Student, $5. Send address and check payable to Georgia Botanical Society to **Teresa Ware, 2 Idlewood Ct., NW, Rome, GA 30165-1210**. Members receive Tipularia without extra charge. Persons wishing only to receive the magazine may become Tipularia associates for $10 a year. Single copies, when available, may be ordered from **Sally Emory**, 7575 Rico Rd., Palmetto, GA 30268 (1991 and before: $5; 1992 and after: $10).

Editorial Information

Tipularia strives to combine the scientific authority of a botanical journal with the readability of a magazine. Some articles are assigned; unsolicited manuscripts are welcomed for consideration. Tipularia is unable to pay for articles or art, but there is no charge for publication of them.

Tipularia

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On the cover:

Pogonia ophioglossoides, rose pogonia
Watercolor painting by Gail Arnott Carr

On the back cover:

Cypripedium acaule, pink lady's-slipper
Trillium rugelii, southern nodding trillium
Watercolor paintings by Gail Arnott Carr

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A Floristic Project in Rabun County, Georgia

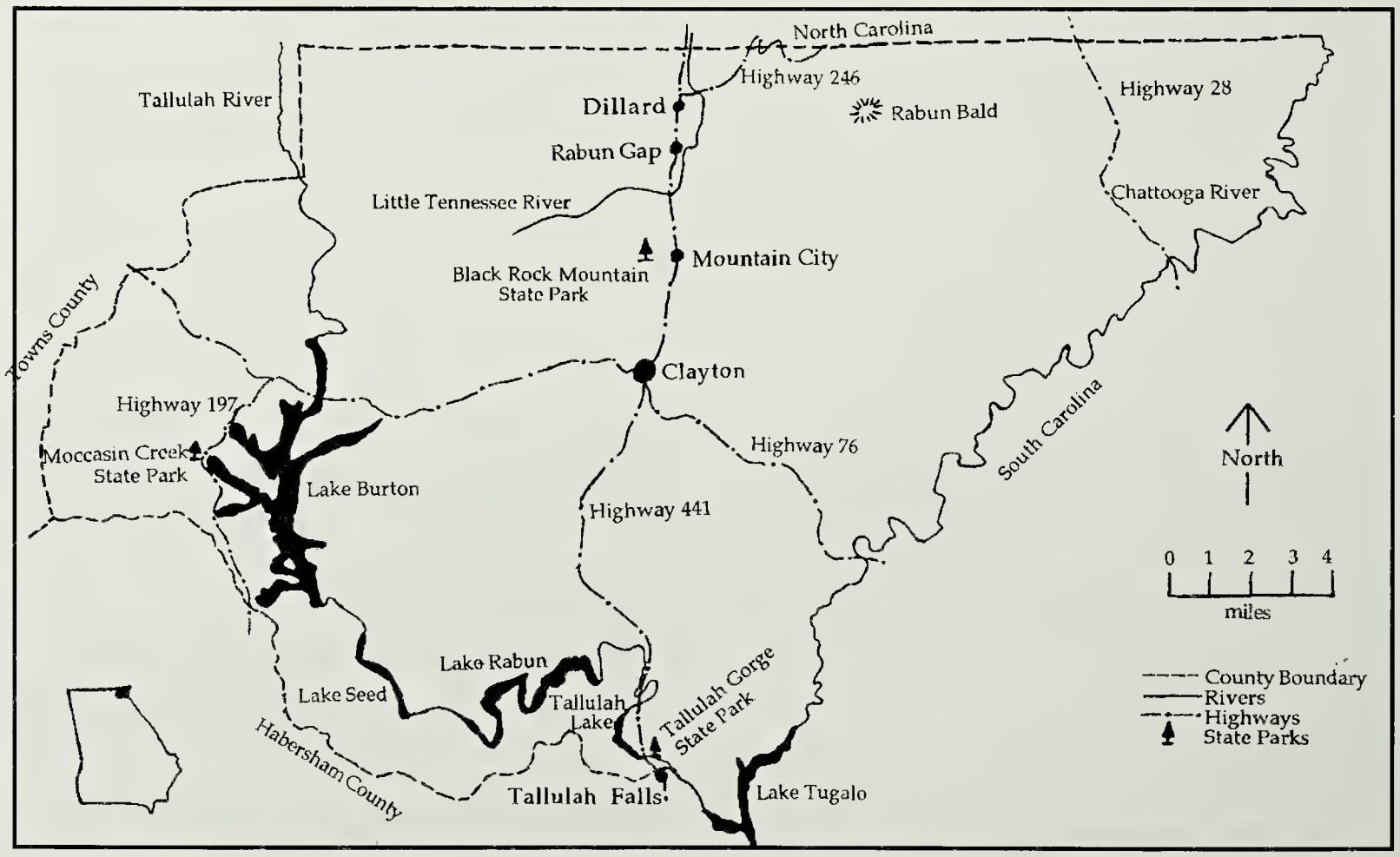
by Carol Howel Gomez

In 1989 a floristic survey of Rabun County, Georgia was begun by the staff and students of the newly established Louise Gallant Herbarium (LGH) at Rabun Gap-Nacoochee School. Using standard methodology and floras, the study has documented 1004 species from Rabun County, Georgia. Much of this research has been published in two articles for the journal of the Southern Appalachian Botanical Society, *Castanea,* from which portions of this article have been excerpted. Floristic work is ongoing and new discoveries are continually being made.

RABUN GAP-NACOOCHEE SCHOOL

Rabun Gap-Nacoochee School is a private college-preparatory boarding school for students in grades 6–12. The school was formed in 1903 by the merger of Rabun Gap School and Nacoochee Institute to provide an education for children from the surrounding mountains. Today Rabun Gap-Nacoochee School has an enrollment of approximately 265 students and boasts a 1400-acre campus. The LGH was established in 1989 by botany teacher Billy Joe Stiles and named for its benefactor, Louise Gallant. It is a lo-

Map of Rabun County, GA



Drawing by Carol Howel Gomez

cal herbarium, housing specimens only from Rabun County, Georgia. The herbarium is one of very few located in a secondary school and therefore provides a unique opportunity to introduce students to the field of botany and herbarium management. Staff and students work to document the flora of Rabun County and to establish a reference collection for the herbarium. The herbarium also houses a slide collection of many species on the check-list.

RABUN COUNTY CHARACTERISTICS

Rabun County, located in the extreme northeastern corner of Georgia, is bordered to the north by Clay and Macon Counties, North Carolina, to the east by Oconee County, South Carolina, and to the west and southwest by Towns and Habersham Counties, Georgia. Rabun County encompasses 368 square miles and is dissected north to south by Georgia Highway 441 and east to west by Georgia Highway 76 (see map). It has 11,648 year-round residents and a summer population of 26,600. The county receives an average annual rainfall of 71 inches and an average annual snowfall of 6 inches. Winter temperatures average 41°F, summer temperatures average 72°F, and the growing season is approximately 160 days (Carson and Green 1981).

Situated in the Blue Ridge Mountain District of the Blue Ridge physiographic province, the floristic study area is characterized by rugged mountains and ridges ranging from 3500 to more than 4600 feet, with valleys that are 1500–2000 feet below the adjacent summits (Clark and Zisa 1976). At 4696 feet, Rabun Bald is the highest peak in the county and the second highest peak in Georgia. The eastern portion of the county is drained by the Chattooga River, the extreme north-central portion is drained by the Little Tennessee River, and the west portion of the county is drained by the Tallulah River. One interesting geological feature in Rabun County is the Tallulah Gorge, located in the southeastern corner of the county. Created by the Tallulah River, the Tallulah Gorge is up to 1200 feet deep and 2000 feet wide, with a river bed drop of 600 feet in approximately 1.5 miles (USGS 1953).

HISTORY AND LAND USE

Rabun County was formed December 21, 1819, after land was ceded from the Cherokee Indians in 1817. In the early 1900s, Georgia Power began construction on a series of six lakes and dams along the Tallulah and Tugalo Rivers, eventually acquiring some 16,767 acres, or approximately seven percent of the land in Rabun County (Rabun County Tax Assessors Office, pers. comm.). The lakes in Rabun County include Lake Burton (2,775 acres), Lake Seed (240 acres), Lake Rabun (834 acres), Tallulah Lake (63 acres), and a portion of Lake Tugalo (597 acres) (Georgia Power 1987). The sixth lake, Lake Yonah, is not in Rabun County.

The Chattahoochee National Forest was established in north Georgia in the early 1900s. The U.S. Forest Service has obtained 148,530 acres of land in Rabun, about 63% of the county. Additional public land in Rabun County can be found in three state parks. In 1939, 1,502 acres were acquired in Mountain City to form Black Rock Mountain State Park, and in 1966, 32 acres were acquired along Lake Burton to form Moccasin Creek State Park (Landrum 1992). In 1993, 3048 acres in Rabun

and Habersham Counties near Tallulah Falls were acquired (either leased or bought from Georgia Power) to form Tallulah Gorge State Park.

PLANT COMMUNITIES

Rabun County is located in the Southern Appalachians section of the Oak-Chestnut Forest Region. Though quantitative vegetative analysis is beyond the scope of this study, a literature summary has been compiled in an effort to ensure that all plant communities are included in the floristic survey. Based on Braun (1950), Dumond (1970), and Wharton (1978), eight plant communities are summarized below. A detailed description is provided in Stiles and Howel (1996).

CHESTNUT OR OAK-CHESTNUT COMMUNITIES

Listed by Braun (1950) as a forest of moderate elevations, the Chestnut or Oak-Chestnut Community (which includes Wharton's Oak Ridge Forest and Oak-Chestnut-Hickory Forest) is the most extensive forest type of the Southern Appalachians, covering dry slopes and ridges with elevations between 1300 and 4500 feet. Once dominated by chestnuts now largely absent due to chestnut blight, the forests no longer resemble their original composition. These communities usually support an understory of abundant ericaceous shrubs. Found throughout the county, one example of this community occurs along Appalachian Trail on the Rabun County/Towns County line.

OAK AND OAK-PINE COMMUNITIES

The Oak and Oak-Pine Communities are also listed as forests of moderate elevations, occupying dry slopes and ridges (Braun 1950). The community is characterized by a dominance of oak in the canopy, and to a lesser degree pine and hickory (Braun 1950). Wharton describes several forests which are dominated by oak or oak and pine including Chestnut Oak Ridge Forest, Broadleaf Deciduous Ridge Forest, and Broadleaf Deciduous-Pine Ridge Forest (also known as Pitch Pine Ridge). Examples can be found in the Low Gap area along the southern end of the county and along the Oaky Mountain Ridge between Rabun and Habersham Counties.

MIXED MESOPHYTIC COMMUNITIES OR COVE HARDWOODS

Forests of moderate elevations, Mixed Mesophytic Communities or Cove Hardwoods are limited to coves and moist lower north slopes. There are typically six to eight dominant trees, the most abundant being buckeye, basswood, maple, silver bell, tuliptree, birch, and hemlock (Braun 1950). These forests often support a rich herbaceous layer. Three of Wharton's communities are included in this category: Broadleaf Deciduous Cove Forest, Boulderfields, and Broadleaf Deciduous-Hemlock Forest. An example of the Broadleaf Deciduous Cove Forest is Till Ridge Cove. A small Boulderfield is located on Black Rock Mountain. The Broadleaf Deciduous-Hemlock Forest can be found along Warwoman Creek and the Chattooga River.

BALDS

In the southern Appalachians, treeless mountain tops of higher elevations are known as balds (Braun 1950). In Rabun County, this community takes the form of what Braun refers to as a heath bald (also known as a shrub bald).The best example of a heath bald

in the study area is Rabun Bald, in the northeast portion of the county.

CLIFFS AND GORGE WALLS

Based on Wharton (1978), these communities are more or less vertical cliffs; some are dry and exposed, others are wet and shaded. They are principally found close to the main Blue Ridge. Cliffs and Gorge Walls are found throughout Rabun County in areas such as the Tallulah Gorge, the Chattooga River Gorge, and on several cliff-sided mountains of the extreme northeast corner of the county, such as Glade Mountain.

MOUNTAIN BOGS

According to Wharton (1978), the mountain bogs are perhaps our rarest mountain environments and support some very uncommon species. Such places occur at the heads of valleys, in soil that is more or less constantly wet (Wharton 1978). Rabun County has several small bogs scattered across it.

Tallulah Gorge

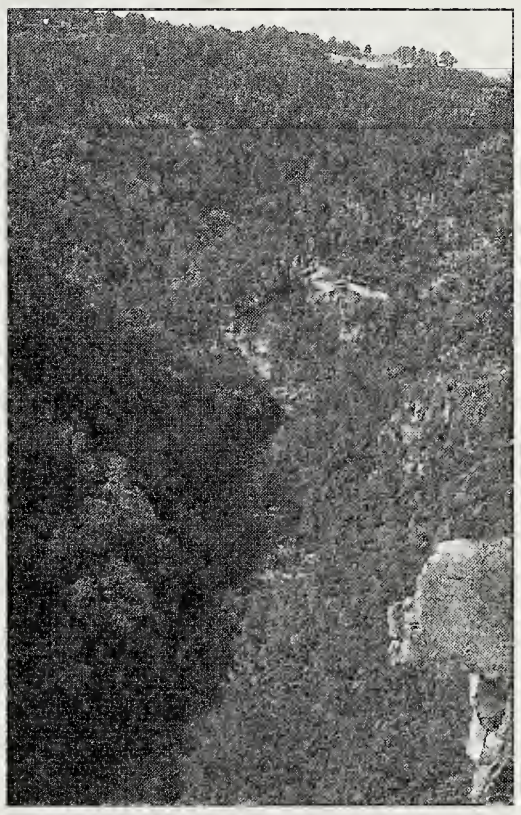


Photo by Carol Howel Gomez

MOUNTAIN RIVER AND FLOOD ZONE

Examples of this community include the Chattooga and Tallulah Rivers. A number of shrubby and herbaceous species are found here. Vegetation developing on rocky or gravely river margins or islands is usually dominated by *Alnus serrulata* (smooth alder) (Dumond 1970).

DISTURBED AREAS

Found throughout the county, these areas include roadsides, power line cuts, fields, lawns, and any other areas which receive constant disturbance by man. The original communities having been removed, these areas now support only weedy species.

FLORISTICS

As of January 1999, the floristic work of the Louise Gallant Herbarium has resulted in the collection of approximately 2490 specimens, documenting 808 species. An additional 196 species are documented in the literature, for a total of 1004 species known from Rabun County, Georgia. Based on Jones and Coile (1988), this study discovered 364 species previously undocumented from Rabun County.

There are 47 pteridophytes, 8 gymnosperms, 238 monocots, and 711 dicots. As mentioned above, the plant list derived from collections made between 1989 and 1997 has been published in two parts in *Castanea* (Stiles and Howel 1996, 1998). A limited number of reprints are available from Bill Stiles, Director of the LGH Herbarium, PO Box 11, Rabun Gap, Georgia 30568.

The largest families are not surprising: *Asteraceae* has 136 species (or 13.5% of all species); *Poaceae* has 80 species (7.9%), *Fabaceae* has 53 species (5.2%), *Cyperaceae* has 47 species (4.7%), *Rosaceae* has 42 species (4.1%), and *Liliaceae* has 41 species (4.1%). The largest genera are *Carex* (30 taxa), *Aster* (22 taxa), *Solidago* (16 taxa), and *Viola* (15 taxa). 155 species (15.7% of all species) are introduced.

SPECIES NEW TO GEORGIA

Six species new to Georgia were discovered. These are considered state records based on Jones and Coile (1988), Radford *et al.* (1968), Wofford (1989), and holdings in herbaria at the University of Georgia and the University of South Carolina in Columbia.

Chelidonium majus (celandine) was found on Hambidge Center property near Dillard, in open area near an old garden. This is a monotypic genus of Eurasian origin and occurs in thickets, fields, hedgerows, and woods from Quebec west to Iowa and south to North Carolina.

Hieracium aurantiacum (king devil) was found in a grassy area near Lake Burton Fish Hatchery. Dozens of individuals were growing in dry soil in open sun in a frequently mowed area. Introduced from Europe, this species occurs in oak-hickory woods, fields, roadsides, and meadows from southeastern Canada and the northeastern United States to North Carolina and West Virginia.

Lapsana communis (nipplewort) was collected at Moccasin Creek State Park near the manager's residence on the edge of a mixed hardwood forest. Naturalized from Europe, this species is found in woodlands and fields in the eastern United States.

Lotus corniculatus (birdsfoot trefoil) was found along Bridge Creek Road west of Tiger, near Stonewall Estates. It is a native of Eurasia and occurs in disturbed and ruderal sites from Arkansas to Delaware south to North Carolina and Tennessee.

Stellaria graminea (stitchwort) was collected in a small wetland on the Rabun Gap-Nacoochee School campus. Introduced from Europe, this species is now found throughout much of eastern North America.

Symphytum officinale (common comfrey) was found in Clayton, near old Georgia Highway 441, in full sun. A native of Eurasia, it occurs in waste places from Newfoundland to Minnesota south to Virginia and North Carolina.

PROTECTED SPECIES

Based on holdings in the LGH and the University of Georgia Herbarium and on Patrick, Allison, and Krakow (1995), 21 species protected at the state and/or federal level occur in Rabun County, one of the highest diversities of rare species in the state. This is due in large part to the fact that many northern species reach the southern end of their ranges in northeast Georgia, and Rabun County has consequently received much attention. In the current study, five protected species were collected, and populations of several additional protected species were visited but no collections were made. In most cases, newly discovered populations of protected species are documented only by photographs. The five collected species are briefly discussed below.

Cymophyllus fraserianus (Fraser's sedge) is listed as Threatened by the Georgia Department of Natural Resources (GDNR) and occurs in rich woods, cove hardwoods, and stream banks. Known from two Georgia counties, there are several populations with numerous specimens of this species in Rabun County, both on private and public property.

Cypripedium acaule (pink lady's-slipper) is listed as Unusual by the GDNR and grows in acid soils of pine woods, in upland woods with pine, occasionally on the edges of rhododendron thickets, and in mountain bogs.

This species is very common to the north, and several very extensive populations occur in Rabun County. The author discovered one notable population on Forest Service property in the Hale Ridge Road area which covered several acres.

Cypripedium calceolus var. *pubescens* (large-flowered yellow lady's-slipper) (Unusual) is found primarily in rich, moist, hardwood coves and forests. Numerous populations of this species have been discovered on north-facing slopes and along stream edges, though the plants usually occur only sparsely.

Hexastylis shuttleworthii (wild ginger) (Unusual) is found in rich woods and forested bog edges, and along creeks. Three populations of this species have been discovered in the northeastern portion of the county.

Sarracenia purpurea (purple pitcher plant) (Endangered) is found in sphagnum bogs, often in laurel and rhododendron thickets, and in wet pineland savannahs. This habitat is very scarce in Rabun County, and most are being overgrown.

SPECIAL CONCERN SPECIES

Based on Georgia Natural Heritage Program (1997), the county supports 38 species of Special Concern. The term Special Concern applies to those species that are not legally protected but whose biological status is uncertain or presumed to be in jeopardy. These species are monitored by the GDNR.

Twenty-one Special Concern species have been collected: *Agastache scrophulariifolia* (purple giant hyssop), *Aralia nudicaulis* (wild sarsaparilla), *Baptisia australis* (blue wild indigo), *Calystegia sericata* (silky bindweed), *Carex scoparia* (broom sedge) *Comptonia peregrina* (sweet-fern), *Cuscuta rostrata* (beaked dodder), *Diphasiastrum tristachyum* (ground cedar), *Drosera rotundifolia* (round-leaved sundew), *Glyceria melicaria* (slender manna-grass), *Juglans cinerea* (butternut), *Leucothoë recurva* (fetter bush), *Lycopodium clavatum* (ground pine), *Lygodium palmatum* (climbing fern), *Panax quinquefolius* (ginseng), *Panax trifolius* (dwarf ginseng), *Pycnanthemum virginianum,* (Virginia mountain-mint), *Scirpus expansus* (woodland bulrush), *Spirea tomentosa* (hardhack), *Trichomanes boschianum* (Appalachian filmy fern), and *Tsuga caroliniana* (Carolina hemlock). Based on holdings at the University of Georgia Herbarium, the collection of *Agastache scrophulariifolia* is the first in the state since 1932. According to Tom Patrick of the Georgia Natural Heritage Program (pers. comm.), the collection of *Cuscuta rostrata* is the first verification of the species in Georgia since 1948.

Ten additional species are on the Georgia Natural Heritage Pro-

***Lycopodium clavatum*, ground pine**

Photo by Carol Howel Gomez

gram's list of species being tracked to determine their conservation status: *Amaranthus retroflexus* (red-root amaranth), *Dirca palustris* (eastern leatherwood), *Disporum maculatum* (spotted mandarin), *Dryopteris goldiana* (Goldie's wood fern), *Galium asprellum* (rough bedstraw), *Gentiana decora* (closed gentian), *Lysimachia quadriflora* (flatwoods loosestrife), *Polygala paucifolia* (gaywings), *Pycnanthemum montanum* (Blue Ridge mountain-mint), and *Stewartia ovata* (mountain camellia).

ADDITIONAL NOTABLE SPECIES

Three species most often associated with the coastal plain have been collected in Rabun County: *Brasenia schreberi* (water-shield) was found in a small man-made pond just west of Georgia Highway 441 and just south of the North Carolina state line; *Stylodon carneus* (= *Verbena carnea*) (vervain) was found near the intersection of Warwoman and Overflow Roads in eastern Rabun County; and *Triadenum virginicum* (marsh St. John's-wort) was found on the edge of Camp Creek Road. Based on Jones and Coile (1988), there are five species with only one other location in Georgia: *Cassia hebecarpa* (wild Senna), *Hieracium florentinum* (king devil), *Hystrix patula* (bottlebrush grass), *Luzula multiflora* (wood rush), and *Rubus allegheniensis* (blackberry).

CONCLUSION

The staff and students of the LGH are continuing floristic work, with the emphasis during the 1999 growing season being on relocating species documented by other workers. The Louise Gallant Herbarium is open by appointment to anyone who is interested in it or the flora project. Arrangements can be made by contacting Bill Stiles.

View from Black Rock Mountain into Rabun Gorge

Photo by Carol Howel Gomez

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***Polygala paucifolia*, gay-wings**
Tallulah Gorge

Photo by Carol Howel Gomez

***Cymophyllus fraserianus*, Fraser's sedge**

Photo by Bill Stiles

Plant Community Classification at Heggie's Rock

by Carol A. Schneier

I stood at dawn gazing across patchy plant communities at Heggie's Rock. Depression pools glimmered in the opalescent light, contrasting with the darker mats of mosses, lichens, and other terrestrial plants. Although many journey to granite outcrops for aesthetic reasons, I was there to catalog its plant communities. I spent two weeks (during April and October, 1998) as a volunteer for The Nature Conservancy of Georgia, which manages this area in Columbia County west of Augusta as an ecological preserve.

Heggie's Rock Preserve covers about 100 acres and is an outcrop of coarse-grained granite towering nearly 70 feet above the surrounding pines and hardwoods. This monolith is one of the most striking examples of granite flatrock in Georgia and has been designated a National Natural Landmark by the U.S. Department of the Interior.

Granite outcrops support unique botanical communities. By some estimates, over 90% of the granite outcrop communities lie within Georgia. Much has been written about endangered species endemic to outcrops, stunning vernal displays of outcrop flowers in the depression pools, and outcrops as giant outdoor laboratories illustrating

Heggie's Rock Overview of patchy communities

Photo from Carol Schneier

soil development and plant succession. Rather than focus on individual species, my study took a broader perspective of dominant species in plant communities.

ECOLOGICAL COMMUNITY STUDY

The Nature Conservancy (in cooperation with government agencies, Natural Heritage Programs, and the Association for Biodiversity Information) has an ongoing international program to produce a standardized system for ecological community classification. This taxonomy is a basis for conservation planning and biodiversity protection, as well as for resource management and vegetation mapping.

International Classification System

One of the things I like about the classification scheme is that the communities are self-naming based on dominant vegetation. For example, a common Piedmont association is the loblolly pine–white oak–pignut hickory forest. Similar to biological taxonomy, the community classification is hierarchical, as illustrated below:

Class: *Forest*
Subclass: *Mixed evergreen–deciduous*
Group: *Cold–deciduous Forest*
Subgroup: *Natural/semi-natural*
Formation: *Mixed needle-leaved evergreen–cold deciduous Forest*
Alliance: *Pinus taeda–Quercus (Q. alba, Q. falcata, Q. stellata) Forest Alliance Association: Pinus taeda–Quercus alba–Carya glabra Forest Association*

The first five levels are determined by physical factors such as community structure, climate, hydrology, leaf seasonality, and other physical factors. Alliance and Association names are derived from the genus or species comprising 25% or greater of the vegetative cover. Dominant species in the plant communities surrounding Heggie's Rock are trees such as pine, oak, and hickory. At the heart of the outcrop, however, dominants are mosses or lichens, an indicator of a harsh environment. For a summary of the communities identified in this study, see page 13.

International Classification Table

Hierarchy	Definition	Examples
Class	Height and structure of the dominant vegetation	Forest Woodland Shrubland
Subclass	Predominant leaf phenology	Evergreen Deciduous
Group	Leaf characters and geography	Temperate needle-leaved
Subgroup	Disturbance	Natural Cultural
Formation	Broadly-defined environmental factors such as elevation and hydrology	Lowland Saturated

STUDY TECHNIQUES

When I started the study my biggest problem was: What defines a community? The patchy vegetation seemed to have infinite variety. Plants varied in size from crustose lichens to 80-foot trees. Study guidelines suggested focusing on areas with a single vegetation type, so I

looked for communities where the vegetation seemed to be floristically and structurally homogeneous and marked study plots using chaining pins and a 100-meter tape.

I surveyed a total of forty-two plots. The largest was 400 square meters, the smallest 1/2 square meter. I captured data about each plot on a survey form as follows:

Descriptive: location, aspect, slope, physiographic region
Soil: pH, soil profile, drainage, texture, structure, moisture
Vegetation structure: percentage cover of trees, saplings, shrubs, herbs, and non-vascular plants
Dominance: tree size and species abundance by cover class

This information was analyzed by computer at TNC regional headquarters, and a taxonomy of communities was derived based on cladistics.

COMMUNITY CLASSIFICATION

Community classification is based on analyzing the study plot data for total floristic composition plus the abundance for each species. A standard cover/abundance class scale is used: 1 (trace); 2 (0.1-1%); 3 (1-2%); 4 (2-5%); 5 (5-10%); 6 (10-25%); 7 (25-50%); 8 (50-75%); 9 (75-95%); 10 (>95%).

Each layer of the canopy (Tree, Tall Shrub/Sapling, Low Shrub/ Seedling, Herb, and Non-vascular) is analyzed for species which cover more than 25% of that layer. Cladistic analysis by computer determines relationships based on both environmental information (e.g.,hydrology, geology, soil, slope aspect and degree, elevation, landform, land use, and disturbance regime) plus the dominant species by cover layer. Although analysis is not complete, preliminary results show at least twelve non-aquatic outcrop communities, as summarized in Table at right.

TENTATIVE COMMUNITIES

Pinus taeda–Quercus alba (loblolly pine–white oak)

This community surrounds the rock outcrop. The successional forest is a relict from when the area was farmed and is characterized by tall trees (>75 feet). The forest is structurally well-developed with overlapping canopy and subcanopy. Little light reaches the forest floor, which is fairly open, is carpeted with dead leaves, and has deep organic soils. It was already described in the classification as I.c.3.N.a.180, *Pinus taeda–Quercus alba–Carya glabra* forest.

Ulmus alata (winged elm)

This community adjoins the *Pinus taeda–Quercus alba* community as the forest approaches the open rock surface. Soils are shallower (about 20 cm) and more acidic, and trees tend to be shorter, although crowns still overlap. The canopy was composed of winged elm intermixed with pignut hickory (*Carya glabra*) and eastern red cedar (*Juniperus virginiana*). More light reached the forest floor, supporting dense stands of upland swamp privet (*Forestiera ligustrina*), muscadine grape vines (*Vitis rotundifolia*), and patches of grasses with occasional wildflowers.

Juniperus virginiana (eastern red cedar)

This woodland community appeared at edges, or as a stand-alone island on the outcrop. Trees were rarely

Community Classification Summary

Class	Preliminary Association	Plot No.	Slope %	Drain	Moisture	Soil			
						pH	Ocm	Acm	Tot
Forest	*Pinus taeda-Quercus alba* 1.c.3.N.a.180	34	7.0%	well	mesic	6.7	12	>30	>42
Forest	*Ulmus alata*	1	8.5%	well	submesic	6.8	11.5	8.5	19
		2	8.0%	well	submesic	6.4	9.0	11.0	20
		3	4.0%	well	submesic	6.0	9.0	9.0	18
		35	12.0%	well	submesic	6.5	11.0	16	27
Woodland	*Juniperus virginiana*	25	14.0%	well	xeric	6.3	16	7	
		26	0.5%	well	xeric	5.8	3.0	11.0	14
		27	3.5%	mod	mesic	6.1	15	4	19
Shrubland	*Forestiera ligustrina*	28	21.0%	well	xeric	6.1	3	0	3
		29	7.0%	rapid	xeric	6.1	6	6	12
		30	5.0%	well	xeric	6.2	5	5	10
Herbaceous	*Schizachyrium scoparium*	13	2.5%	mod	mesic	6.2	7	3	10
		14	9.5%	mod	mesic	6.4	9	0	9
		15	7.5%	mod	mesic	6.5	3	9	12
		42	10.0%	mod	mesic	6.5	30	0	30
Herbaceous	*Senecio tomentosus*	16	8.0%	poor	hygric	6.4	8	9	17
		17	7.2%	poor	hygric	6.5	15	3	18
		18	1.8%	poor	hygric	6.0	12	3	18
Herbaceous	*Selaginella tortipila*	7	0.0%	well	mesic	6.9	3	0	3
		8	11.0%	well	mesic	6.8	11	0	11
		9	6.3%	well	mesic	5.6	9	3	12
		37	8.0%	well	mesic	5.4	5	0	5
Nonvascular	*Polytrichum commune*	10	.0%	-poor	hygric	5.8	9	0	9
		11	.0%	-poor	hygric	5.2	6	8	14
		12	.0%	-poor	hygric	6.4	7	0	7
		41	5.0%	-poor	hygric	6.2	12	0	12
Nonvascular	*Grimmia laevigata*	19	17.0%	rapid	+xeric		0	0	0
		20	.0%	+poor	hygric	6.8	1	0	1
		21	6.5%	rapid	+xeric		0	0	0
		39	12.0%	rapid	+xeric		0	0	0
Nonvascular	*Cladonia subtenuis*	31	1.5%	well	xeric	6.3	1	0	1
		32	1.5%	well	xeric	6.3	1	0	1
		33	11.0%	rapid	+xeric	5.8	2	0	2
		40	.0%	well	xeric	6.5	8	0	8
Nonvascular	*Parmelia conspersa*	4	6.5%	rapid	+xeric		0	0	0
		5	7.3%	rapid	+xeric		0	0	0
		6	26.0%	rapid	+xeric		0	0	0
		38	4.0%	rapid	+xeric		0	0	0
Nonvascular	*Peccania kansana – Staurothele diffractella*	22	6.8%	rapid	+xeric		0	0	0
		23	15.0%	rapid	+xeric		0	0	0
		24	6.7%	rapid	+xeric		0	0	0
		36	10.0%	rapid	+xeric		0	0	0

Notes: + = very – = somewhat depth in cm

taller than 30 feet. Edge communities were denser than islands, forming a solid wall of dark green as one stepped from the forest to the bare rock. In island communities the trees were spaced with non-overlapping canopies. Soils were more acidic and shallower than in previous communities. Dry islands hosted dense grass (usually *Schizachyrium scoparium*) under the trees, while wet islands were covered with moss (*Polytrichum* sp.).

Forestiera ligustrina (upland swamp privet)

This shrubland community dominated several small islands (where the *Forestiera* is the tallest shrub). The swamp privet was densest when it was in an understory edge community, forming a thick tangle just as one transitioned from the forest to the bare rock surface. Soils were generally thin (<12 cm), with protruding boulders and fairly dry conditions. The broken appearance of the bedrock suggested there were soil-filled cracks which the *Forestiera* roots could exploit. Soil pH was about the same as the red cedar communities, but drier, possibly due to the greater average slope which resulted in faster water runoff. Island communities were prone to dry conditions due to the lack of shade, hotter temperatures, and drying winds.

Schizachyrium scoparium (little bluestem)

This grass community was similar to several previously classified prairie communities with various species of *Schizachyrium* as dominants. However, my study plots had less biodiversity due to exposure to harsh island conditions on the outcrop. Soils were slightly less acidic and moister than in the *Forestiera* community. Although average soil depth was similar to that of the *Forestiera* community, large cracks in the rock appeared to be absent. Thick grass clumps were interspersed with wildflowers such as striped garlic (*Allium cuthbertii*) and confederate daisy (*Viguiera porteri*).

Author Carol Schneier collecting data at Heggie's Rock

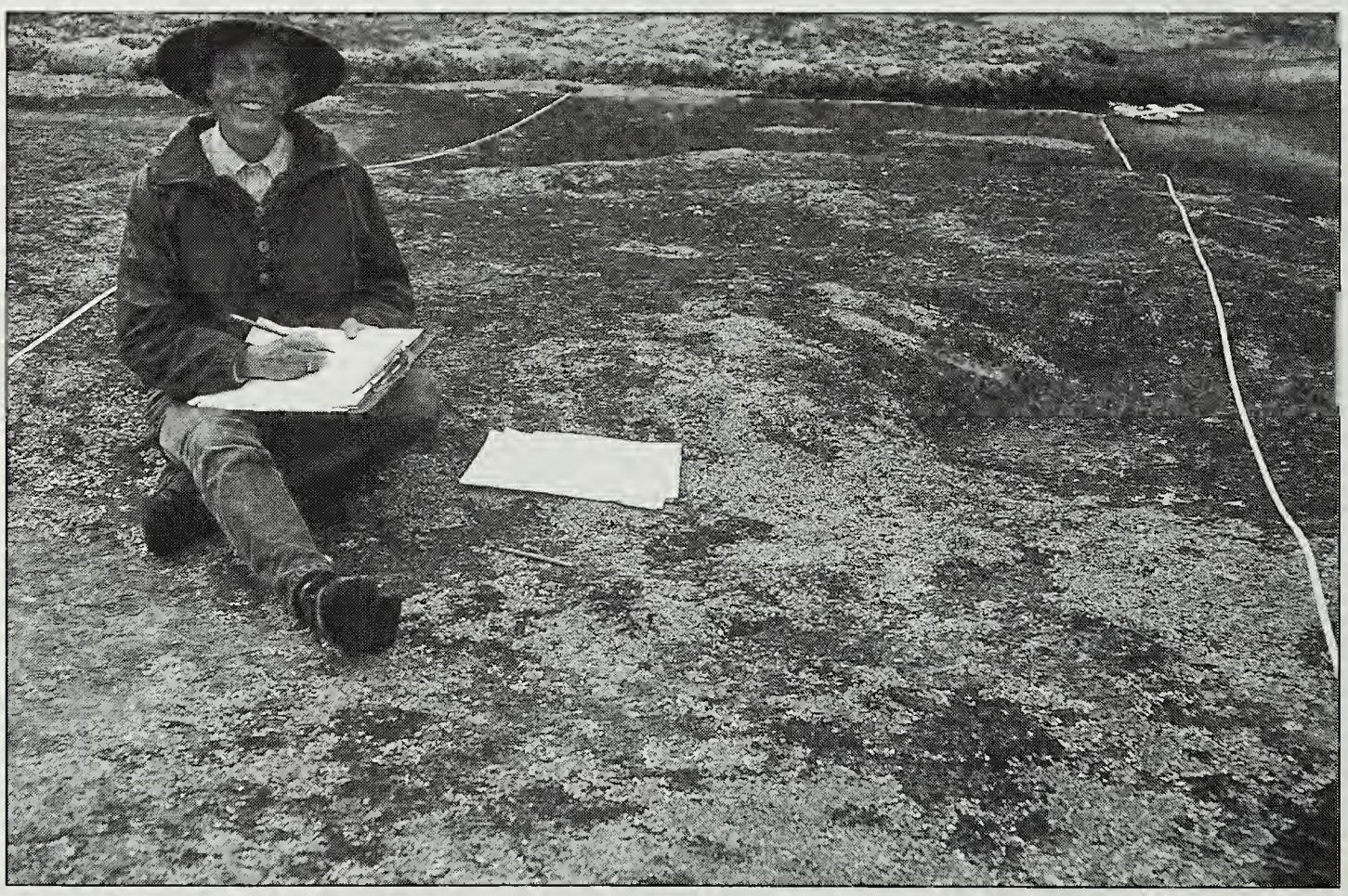


Photo from Carol Schneier

Senecio tomentosus (woolly groundsel)

This hygric (moist) community had poorly drained organic soils supporting moderately dense stands of woolly groundsel on moderate slopes. Soils tended to be deeper and more organic than in the *Schizachyrium* communities. Various grasses, *Selaginella*, and other wildflowers were also present.

Selaginella tortipila (twisted-hair spikemoss)

Mats of *Selaginella* consisted of very dense stands of a single vascular plant species (up to 95%). Islands ranged in size from less than a square meter to 30 square meters. Soils were thin (3-12 cm) and composed of brown peat-like tangles of decaying spikemoss. Acidity varied, the most acidic island having a pH of 5.4. *Selaginella* mats sat like flat pillows on the bare rock surface, with little to anchor them. In some places, small mats had been displaced by heavy runoff and moved intact several feet down the rock face.

Polytrichum commune (hair-cap moss)

Dense, vividly green stands of *Polytrichum* either formed islands or carpeted the soil under red cedar trees. Shallow soils were moist, poorly drained, acidic, and rich in organic material. As in the *Selaginella* communities, the moss mats also sat upon the rock surface. In places torrents of runoff had piled up moss mats like so much living green carpet.

Grimmia laevigata (resurrection moss)

These moss communities occupied exposed islands on their own or edged other communities. In many cases, resurrection moss was the first non-lichen plant to colonize exposed surfaces. In the harshest areas it grew only in partially shaded areas (either on north-sloping rock or shaded by nearby trees). Resurrection moss appears almost black when dry, but turns a deep forest green within minutes of being moistened.

***Selaginella* study plot at Heggie's Rock**

Photo from Carol Schneier

Cladonia subtenuis

Lichens dominated the harshest and driest situations on the outcrop. *Cladonia* communities tended to be small islands on flat areas of exposed rock surface. Soils were present(!) but very thin, generally less than 2 cm. In the densest communities, *Cladonia subtenuis* and reindeer moss (*C.rangiferina*) carpeted over 80% of the rock surface with balls of lichens. Like the *Grimmia* communities, *Cladonia* communities were generally partially shaded.

Parmelia conspersa

This was the hardiest of the foliose lichen communities. Although there was no soil, *Parmelia* was able to cover moderately sloping exposed areas of the rock as long as they were not south-facing and shadeless. Colonies were surprisingly dense (up to 95% of the cover). Concentric growth patterns suggested that the lichen was difficult to start from spores, but once the lichen had a "toehold" on the rock it spread vegetatively.

Peccania kansana–Staurothele diffractella

Although the heart of Heggie's Rock appears bare, it is completely covered with brown crustose lichens. Fresh outcrop granite is a light salt-and-pepper gray, while after a rain, *Staurothele diffractella* turns a rusty brown and *Peccania kansana* turns a deep forest green within minutes. These lichens are well adapted to extremely hot, dry, and exposed conditions on the heart of the outcrop.

COMMUNITY MORPHOLOGY

Generally communities were linear. Plant species might rapidly change within a decimeter in one direction, but remain the same for dozens of meters in a perpendicular direction. This reminded me of the linear communities found in another harsh environment, the seashore. Commuities around depressions tended to form concentric rings, mirroring the gradually deepening soil. Islands were sometimes composed of concentric communities, but were also frequently entirely of one community.

Most often, communities graded into each other over a space of a few to tens of meters. For example, a *Selaginella* community might grade into a *Cladonia* community. However, sometimes community boundaries were abrupt, with "crack communities" being the most dramatic examples of sharp ecotones. A large pine island at the top of the rock hosted a huge ancient loblolly (close to 30 meters tall), yet within a dozen meters of its base are *Cladonia* communities.

ROCK OUTCROP HYDROLOGY

During both study periods rain arrived after a prolonged dry period. This gave me a chance to observe the hydrology of Heggie's Rock, which turned out to be far more complex than at first glance.

I had always been puzzled as to why one depression pool supported one community (e.g., *Diamorpha*), while an adjacent pool which looked similar would have a totally different community (for example, *Cladonia*). The rains allowed me to watch the pools fill, overflow, and drain. After one all-night rain a miniature drainage system emerged on the exposed outcrop. Several pools might feed each other, while another would be blocked by a small hump in the rock. Several inches of water in the connected pools might last a couple of

weeks, but the orphan pool would be bone dry in a few days. These microwatersheds need to be mapped, as under the extreme conditions on the outcrop, plant species amplify tiny environmental differences to produce communities with quite different dominant species.

In October and, especially, April, there was frequently a heavy fog in the early morning, which burned off by midmorning. At times I felt I was in a "cloud forest." Droplets of water condensed on the leaves of some plants, and *Selaginella* mats were moist when I ran my hand across them. Given the shallow soil under the lichen, moss, and *Selaginella* communities I suspect the morning mist forms a significant part of their water supply in the late spring and early fall.

During my stay in October, the summer drought was broken by a heavy overnight rain. The following morning I contemplated brimming depression pools near the top of the rock and delighted in the rejuvenated colors of the lichens and mosses. I was startled to see the mirror surface of the largest pool broken by spreading concentric circles, as if a large fish had gulped an insect on the surface. Knowing there were no fish in the pool, I dismissed my observation as the pool quieted. However, about 20 seconds later the ripples spread again. I quickly investigated. The disturbance was caused by air bubbles from a tiny orifice on the lower southern rim of the pool. For the entire day following the rain, at regular 20-second intervals, a "belch" of air would break the surface, causing ripples, and then the pool would resume its mirror surface. Here was another clue to the puzzle of pool diversity: underground plumbing!

I speculate that some of the most permanent pools are connected to chambers which extend under their rims, acting as water reservoirs. As these chambers fill after a rain, trapped air might force its way out through a narrow entry neck or crack. The longevity of the belch period (lasting at least 12 hours) implies these chambers could be quite large, perhaps as large as the pool itself. Such chambers might slowly resupply the pool as water evaporated, allowing the pool to hold water for periods far longer than any of its neighbors. Underground plumbing could account for the relative rarity of the pools hosting quillworts (*Isoetes* spp.), which require extensive wet periods. The hydrology of Heggie's Rock certainly needs more investigation.

***Polytrichum* study plot at Heggie's Rock**

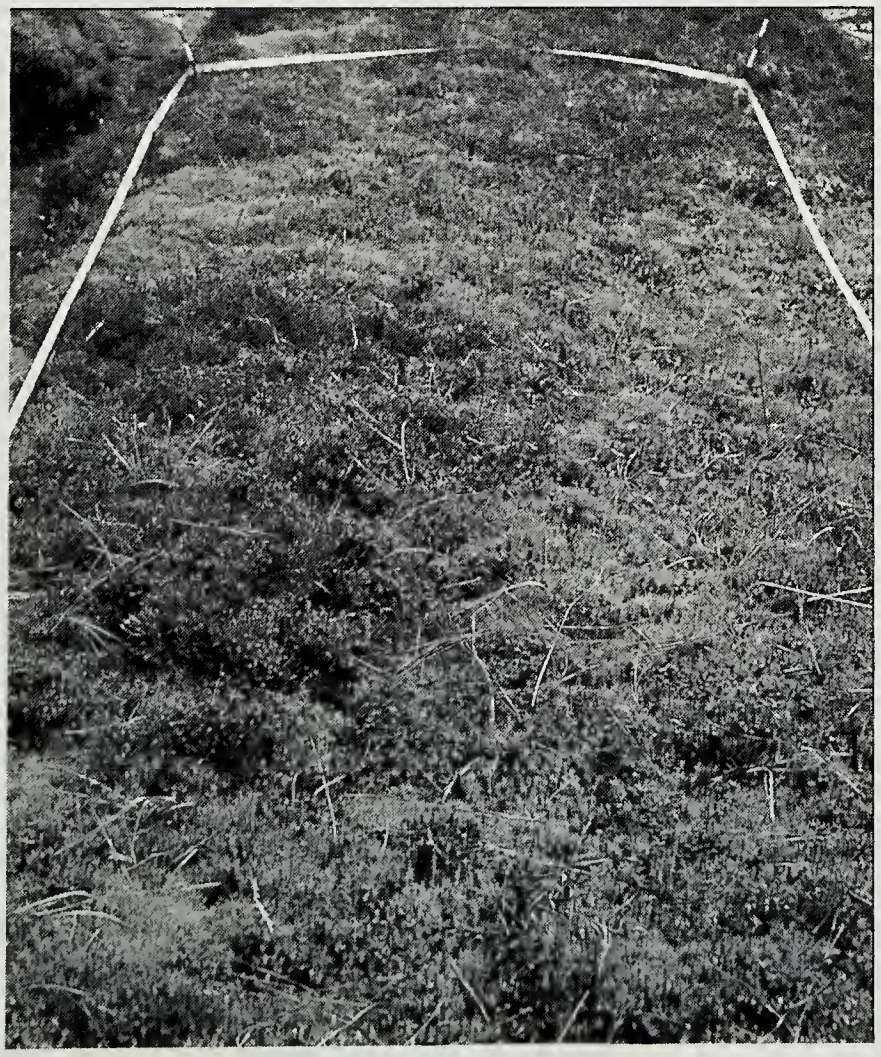


Photo from Carol Schneier

SUBTLETIES OF OUTCROPS

Studying outcrop communities gave me greater insight into their diversity. In addition, I enjoyed the opportunity to live in a field camp at Heggie's. There were many superb moments: the play of light on the rock from sunrise to sunset, the speckled canopy of stars overhead, the glimmer of the depression pools in silvery moonlight, the howling of the coyotes, the sigh of the wind in the loblollies, the calls of the pileated woodpecker, and the movement of deer or rabbits browsing on the island vegetation.

Heggie's Rock supports several finely tuned patchy ecosystems. Each plant community is superbly adapted to its niche. Each amplifies tiny environmental differences into completely different plant dominants. Although some people believe that granite outcrops are only good for quarries or refuse dumps, these areas have much to teach us about environmental subtleties. Protection of these areas needs to be expanded because of their fragility and complexity, as well as their aesthetic appeal. T

Additional Reading

Allison, James R., 1994, Lair of the snorklewort: Stone Mountain, Tipularia 9:37-40.

Emory, David L., 1987, Taking it for granite, Tipularia 2(1):20-23.

Weakley, A.S., K.D. Patterson, S. Landaal, M. Pyne and others (compilers), 1998, International classification of ecological communities: terrestrial vegetation of the southeastern United States, working draft of March, 1998, The Nature Conservancy, Southeast Regional Office, Southern Conservation Science Department, Community Ecology Group.

Heggie's Rock patchy communities

Photo from Carol Schneier

Oconee Bells Adventure

by Alberta Smith

On March 20, 1999, the Georgia Botanical Society took a field trip to Tallulah Gorge to see the persistent trillium, and we were scheduled to have Tom Patrick lead us also to the only site in Georgia where the Oconee bells, *Shortia galacifolia,* occurs as, perhaps, a native stand.[1] But Tom had scouted the primitive dirt road in Rabun County leading to the site the day before and decided we shouldn't attempt it, so we visited the display of Oconee bells at Devil's Fork State Park in South Carolina instead. However, near the day's end, Richard and Teresa Ware and my husband, Paul, and I were still determined to find the Georgia Oconee bells. Tom Patrick couldn't accompany us but gladly gave us mileages, his USGS Quad, advice to use Richard's 4-wheel drive, best wishes, and assurance that we wouldn't have any trouble finding the flowers.

Back in Georgia, we found the paved Glade Mountain Road, which turned into a narrow, one-lane dirt road as predicted. About 37 miles from Devil's Fork we parked our van, as instructed, and joined Richard in his Jeep. It was now 5:40 p.m., and we still had about 5 miles of back-country dirt roads to negotiate. Spring was supposed to arrive at 8:46 p.m., darkness about 7:15.

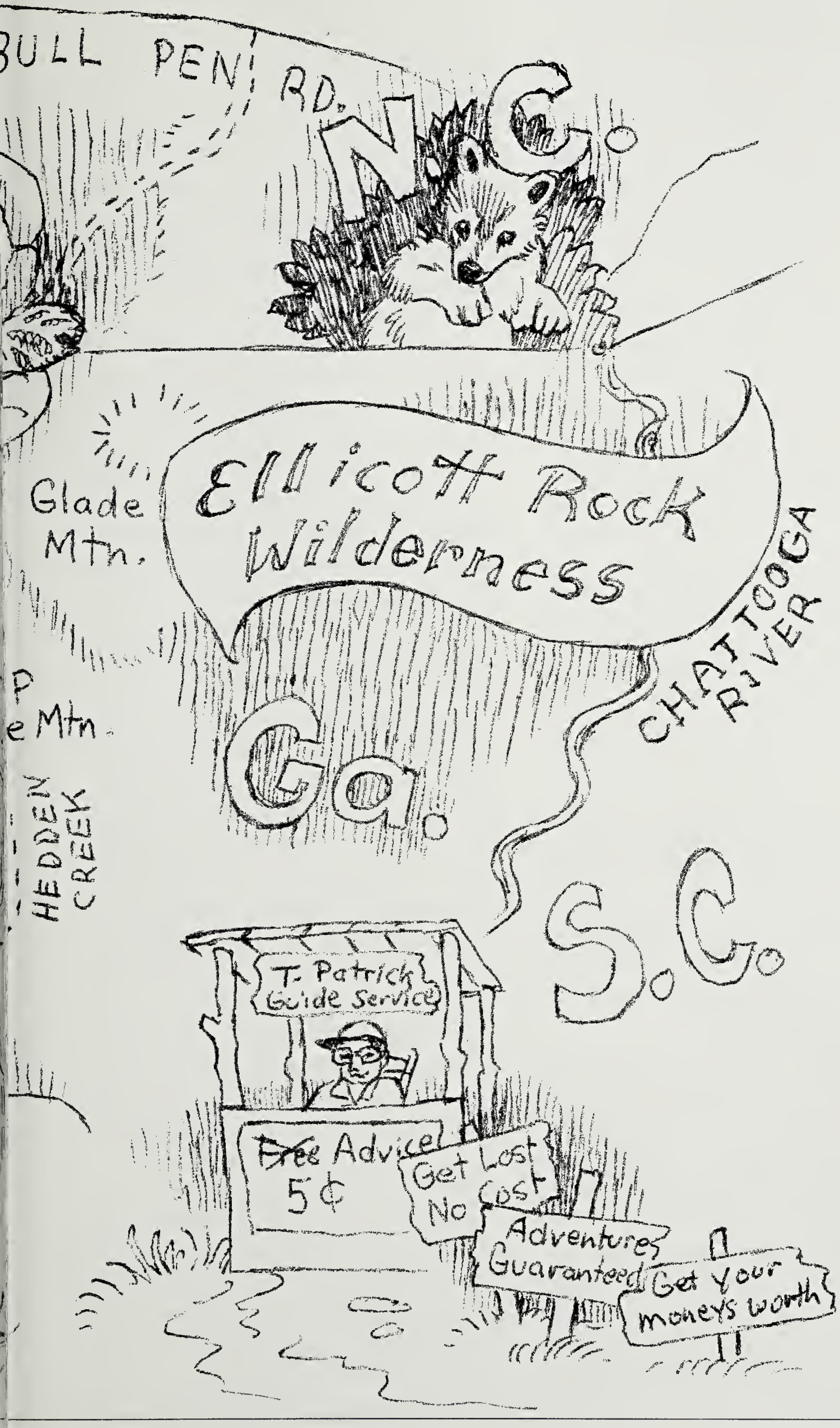
Soon forks in the road appeared that Tom hadn't mentioned. Are we on the right road? Who has a compass? Is this the wooden bridge where we're supposed to park? Tom had said to park near a wooden bridge, walk 100 yards, then follow his orange-flagged trail. But it can't be–it's only 4.6 miles, and Tom said 6.4. Had we taken the wrong fork? Now which fork in the road should we take? We drove left across the bridge into an old logged-off area. The jeep struggled up the eroded hill until the road was blocked by fallen logs and seemed to peter out. Wrong fork. We could never get in 6.4 miles on this road. We decided to try the right hand fork.

Oconee bells at Devil's Fork State Park

Photo by Alberta Smith

Oconee Bells Adventure

Drawing by Elaine Hearn Rabon


BULL PEN RD.
N.C.
Glade Mtn.
Ellicott Rock Wilderness
CHATTOOGA RIVER
HEDDEN CREEK
S.C.
T. Patrick Guide Service
Free Advice 5¢
Get Lost No Cost
Adventures Guaranteed
Get Your moneys worth

And that's where the *real* adventure began! How did Tom get through on this road? Someone had gotten through–there were fresh tire tracks. Who else would drive back into this remote area except Tom Patrick? But what did he drive to get here? Richard with his jeep nobly negotiated boulders, narrow, deeply weathered gullies, and foot-deep pools of standing water. There was a limit, however, and the very narrow, washed-out ravine ahead of us was it.

It was 6:10 p.m. when we abandoned the jeep. We had come in about 5.7 miles and were getting *so* close. "Let's walk the rest of the way." Paul and I were determined and surged ahead at a unrelenting pace. Tire tracks continued, and once in a while there were footprints. They must be Tom Patrick's. How could Tom have even considered bringing us back here?! Suddenly the "road" made a 3-to-4-foot vertical drop down a boulder. But the tire tracks continued–he made it! What was Tom driving? "There's an orange and black flag tape dangling from the branch." Tom said he had marked the trail with an orange tape–was that it? Wouldn't he have said "orange and black?" Then we saw fragments of solid orange tape marking the road itself.

Racing now against darkness, gauging where 6.4 miles should be, Paul and I decided we were about at that distance. No sign of the Georgia Oconee bells. It was now 6:40, and I turned around to head back. Paul sprinted another five minutes up the road, but to no avail. Disappointed and exhausted, we were glad the return trip was an easy downhill. We arrived back at the jeep a little after 7 p.m., and darkness had settled in.

Before beginning our retreat, we re-zeroed the odometer on Richard's jeep. We knew if we could just make it over the first stretch of rough road ahead, we should be able escape from here–wherever that was, since we really didn't know where we were. But did we have enough gas? The warning light flashed, and the gauge said "empty." We crossed our fingers and said a little prayer.

Richard concentrated intently as we slowly lurched over boulders and edged through a badly scoured passage with the jeep at a 40-degree angle. Then Richard said, "There's someone coming up the road with a flashlight." That couldn't be–who would be out here in the middle of nowhere at this time of night? We all stared intently ahead into the darkness. "It must be a reflection from our own headlights." Then we all saw it–a moving light!

I immediately said, "It must be Tom Patrick coming to find us! He knew we'd get lost." But it was not Tom Patrick. It was another couple. They had been afraid to go through the high water over the road, even though they had a rugged, highly perched, four-wheel-drive pick-up truck. Richard's first words of greeting were notable, "We're a little bit crazy, but we're out looking for something we can't find." I thought that very concisely worded statement explained everything but also cleverly revealed nothing in the same breath.

We never did find out where the couple was headed in the darkness, but we did learn something of *our* whereabouts from them and also the reason for the tiretracks. They explained that they had been stopped by the US Forest Service earlier that day for riding ATVs on that road. They had been told

that they could not ride their Georgia-licensed and -insured ATVs in North Carolina. **North Carolina??** It turned out that the flooded area of the road marked the North Carolina border–we were in North Carolina! Now we were *really* glad we hadn't told them we were looking for the only place in Georgia where the Oconee bells grew!

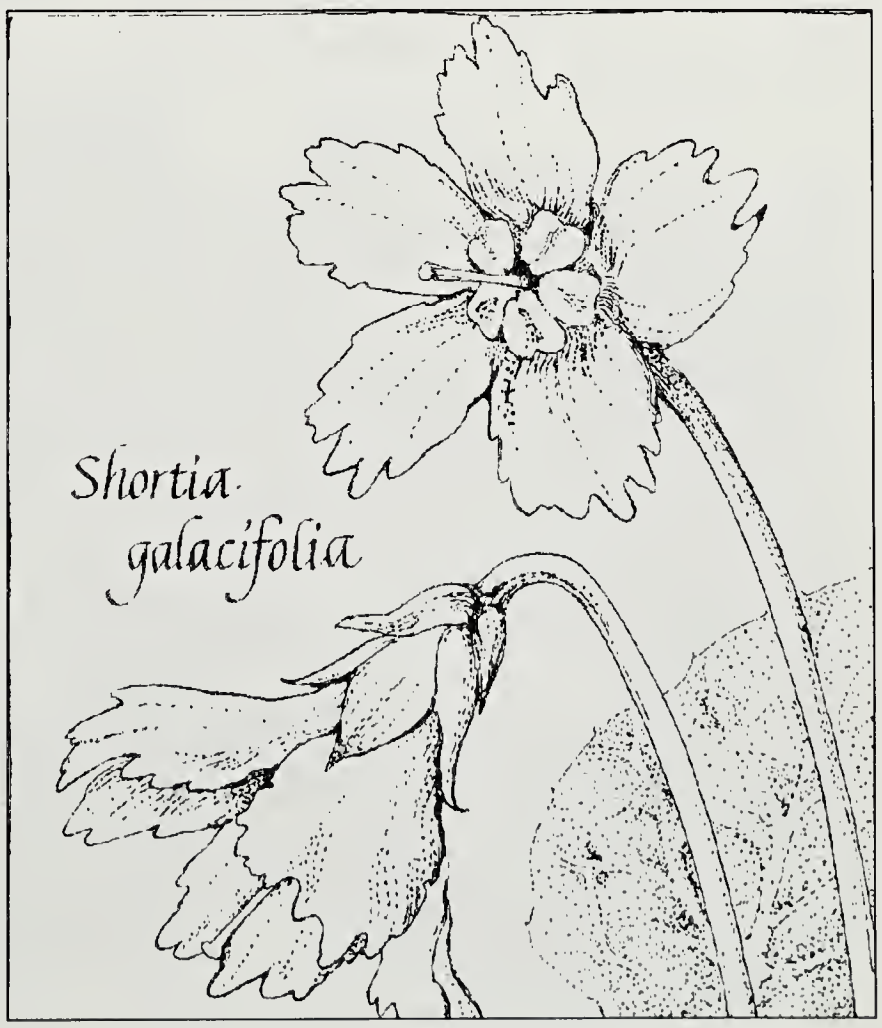
It was 0.4 mile back to the Georgia State Line, and another 0.6 mile back to where the fork in the road occurred near the wooden bridge. The bridge was at the 4.6 mile mark. Tom Patrick had said 6.4. The more we thought about it, the more suspicious we became. Tom had also mentioned that the trail to the site began in a logged-off area. This was the only logged-off area we had seen. It was nearly 7:30 now and too dark to do any more exploring. So Richard and Teresa returned to Rome, and Paul and I returned to Athens without seeing the Georgia Oconee bells.

Sunday morning in Athens, Paul and I pored over the USGS Quad and, with the help of GIS, discovered the roadway we had followed eventually met Bull Pen Road, a dirt road that skirts the north edge of the Ellicott Rock Wilderness about a mile and a half north of the Georgia–North Carolina border. Doing mileage calculations, we figured that our search for **Georgia** Oconee bells had brought us to 1/3 mile from Bull Pen Road, over a mile into **North Carolina**! I cut a piece of thread to measure 4.6 miles on the USGS Quad mileage scale, then carefully placed it on top of the mapped roadway. It brought us to the exact location of the Oconee bells as marked by Tom Patrick on the map–Tom, how could you?! I e-mailed this information to the Wares.

I emerged from this experience more determined than ever to discover this isolated niche where the Georgia Oconee bells can be found, and with a better understanding of why the Georgia Botanical Society now requires participants to sign liability release forms. Richard Ware acquired a new appreciation for his jeep, it having survived its first test of being able to handle primitive mountain roads. All of us are looking forward to our next journey up Glade Mountain Road.

[1]*In the May 1987 issue of Tipularia, an article by Steven M. Jones ("Shortia: solving one mystery") suggests that this population of Shortia in Georgia is* not *native. The drawing below originally appeared with that article.*

Oconee bells. Drawing by Lois Lovejoy



Coloring the Rose Pogonia

By Gail Arnott Carr

Silty mud squished through my toes as I trudged, up to my knees, through soupy brown water. I wasn't sure what my bare feet might discover hidden in the mud of Green Swamp, North Carolina. At the very least, I was apprehensive. Was this worth it?

My husband and friends watched from the shore. Among them was Christina Bird, our group expert on wild orchids. She had assured me, in an offhand manner, that a barefoot trudge through opaque swamp water would be worth it for a close-up sighting of *Pogonia ophioglossoides,* or the rose pogonia orchid. My focus was on the little blur of pink sitting atop the grassy mud pile in the middle of the slurry. With my camera in one hand and a bunch of muddy reeds in the other, I pulled myself through the muck to face the payoff–a cluster of the rare rose pogonia in full bloom!

Field research is an important component of my wildflower paintings. My objective is to portray the wildflowers in their natural environment, and the more rare or endangered the plant the better. I also like to create groups of paintings from the same ecosystem. Some of the wildflowers will be common but beautiful; others may range in status from "infrequently seen" to "endangered." I take particular pleasure in surprising people with the diversity and special beauty of wildflowers, and I consider painting to be a wonderful way to expose and educate the public to the value of our native plants.

When photographing wildflowers, I've found that it's not enough to use one photo for reference. Typically I shoot a series of images of the subject, depicting the foreground, close middle ground, and far middle ground. All of these images may have a depth of field of only a few inches, or in some cases less than an inch. I also shoot a picture of the background and of the plant as a whole, for general reference.

After my film is developed and I have slides in hand, I'm still several stages away from actually beginning to paint. I analyze my slides, looking for two things: first, a way to create a dynamic composition from the images available; and, second, the means to depict the flower/plant in a botanically accurate way. Doing thumbnail sketches, I begin working with the slides available to create a "composite image." I may use as many as four or five slides for the final composition.

Color, shadow, and texture are important elements that can greatly affect composition. Color studies help define these elements and save time when painting. When I do color studies, I like

to work small, usually on an 8.5x11-inch sheet, and in pastels. The pastels enable me to block in color and shadow quickly, while allowing some easy color blending to approximate watercolor techniques.

The next stage is to pencil-sketch the image onto watercolor paper. I like to work fairly large, on full sheets of rag paper measuring 22x30 inches. This is a part of the process that I particularly enjoy, in spite of the fact that the large size can sometimes make "composite" sketching cumbersome.

Ready to paint? Not yet! The last step before painting is to apply a mask (a resist) to the foreground and borders of the image area. Once this dries, it will protect the foreground and contain the background, which I paint first using large watery washes and broad strokes.

After the background is well defined, I gently peel off the mask and finally begin to paint the flowers, individual leaves, and stems. For the foreground I use a combination of dry brush, washes, and glazing. A glaze is a technique where one color is applied on top of another color. Different colors may be used, or layers of the same color. I do a lot of glazing in the foreground of my paintings, which helps to develop depth and subtlety in the images.

The final stage of painting takes time and scrutiny. I must be sure that all elements of the composition are in balance and flow properly, including foreground and background. Shadows must be correct and details well defined, and color must work so that areas of interest pop out to grab your attention.

I find working in watercolor to be challenging and rewarding, and it is an excellent creative medium, but my love of nature is what inspires me. I value the time I spend slogging through swamps and cold mountain streams. Each new flower discovered in the wild is a special gift, each familiar inflorescence found like greeting a friend. I consider myself blessed to be able to communicate and share those things with others through my paintings. T

Two of the reference photos used to create the composite image for the painting

Photos by Gail Arnott Carr

The Altamaha River

by Keith R. Tassin

The Altamaha River, which flows through the coastal plain of Georgia, is truly Georgia's River. Formed by the confluence of the Ocmulgee and Oconee Rivers, with headwaters near the cities of Atlanta and Athens (see map), the Altamaha River drains over 1/3 of the largest state east of the Mississippi River. The river system is undammed in the coastal plain, which is a real rarity in modern times. With over 135 miles of winding river, vast swamp forests, bluffs, sand ridges, and tidal marshes, the Altamaha River is a natural wonder. The river has been famous since a day in 1765 when John and William[1] Bartram came upon a flowering shrub that they had not encountered elsewhere in their journeys throughout the Southeast. As many of us know, that shrub was the mysterious vanishing *Franklinia*, which, although thriving in cultivation, has not been seen in the wild in over 100 years.[2]

The natural botanical wonders of the Altamaha River continue to bring attention to it today. In the early 1990s, The Nature Conservancy identified the river as one of the "Last Great Places" in the world and began to inventory the lands and waters in the lower Altamaha basin. This inventory shows that this area has a tremendous amount of biological diversity including over 100 plant and animal species that are considered rare or endangered in the state of Georgia. Even more significant than the rare species which occur in the basin is the high quality of the natural habitat remaining around the river.

The floodplain of the Altamaha ranges from one to six miles wide and includes a variety of natural plant communities. The tidal reaches of the river are forested by tidal bald cypress–tupelo forests. This forest type is one of the most species-rich swamp types in North America, containing a diversity of herbaceous plant species that carpet the forest

Aerial view of the Altamaha River

Photo by Keith R. Tassin

floor. Many of the tidal forest areas in the Southeast were converted to rice plantations in the early 1800s, which attests to the high fertility of these soils. These tidal forests are bordered along the river channel by patches of tidal freshwater marsh, which contain a medley of grass, sedge, and forb species. Of particular interest in these marshes is a very showy rare plant in the mint family known as narrowleaf dragonhead (*Physostegia leptophylla*). This plant can reach heights of four feet or more and has abundant pink flowers that command attention when they bloom in these marshes at midsummer.

Further upriver, the floodplain is forested by bald cypress–tupelo forest in the wetter sloughs and various bottomland hardwood forest assemblages on the slightly elevated ridges. Distinct natural community types found in these hardwood areas include laurel oak forest, overcup oak–water hickory forest, sweetgum–mixed bottomland oak forest, and spruce pine–mixed bottomland oak forest, with upland laurel oak–live oak forest on the highest ridges. Rare and unique species which are known to inhabit these bottomlands of the Altamaha include ciliated tickseed (*Coreopsis integrifolia*), needle palm (*Rhapidophyllum hystrix*), and the only two known populations of Florida corkwood (*Leitneria floridana*) in the state of Georgia.

The south side of the Altamaha River is bordered in many places by steep bluffs. These bluffs are unique in that they are forested by hardwood forests similar to what would be found in the piedmont of Georgia. More common species include white oaks, pignut and mockernut hickories, beech, and magnolias. These forests provide habitat for Alabama milkvine (*Matelea alabamensis*) and yellow milkvine (*Matelea flavidula*), two of the rarest plant species along the Alta-

Bottomland hardwood

Alabama milkvine

Photos by Keith R. Tassin

maha. In fact, the population of Alabama milkvine along the river is the only known population of this species in the Atlantic coastal plain. These bluffs also provide habitat for less rare species such as green-fly orchid (*Epidendrum conopseum*) and bluff white oak (*Quercus austrina*).

The north side of the Altamaha is bordered by an expansive sand ridge that runs from McIntosh County near the town of Darien to the mouth of the Ohoopee River west of the town of Glennville. This sand ridge was naturally forested by longleaf pine–scrub oak and upland laurel oak–live oak communities. Although large areas of these natural habitats remain along the river, much of the sand ridge has been converted to slash and loblolly pine plantations. The sand ridges along the Altamaha harbor some of the most significant locations of rare species in the basin. These include two of the largest populations of the Georgia plume (*Elliottia racemosa*), a plant known only from the state of Georgia, and the only two known populations of Radford's dicerandra (*Dicerandra radfordiana*) in the world. Other rare and unique plant species found on the sand ridges of the Altamaha River include velvet sedge (*Carex dasycarpa*), Feay's pink-tassels (*Dalea feayi*), trailing milkvine (*Matelea pubiflora*), sprawling goat's rue (*Tephrosia chrysophylla*), and Carolina pineland cress (*Warea cuneifolia*).

The Altamaha River is one of the most ecologically significant areas remaining in the United States, if not the world.

Bordering the lower half of the Altamaha to the north and the south are extensive areas of flat pinelands. Historically forested by longleaf pine ecosystems, much of this area has been converted to slash and loblolly pine plantations. Intermixed within these flat pinelands are a variety of isolated wetlands including pond cypress ponds, tupelo ponds, and bay forests.[3] The best example of this mosaic of longleaf pine-associated communities in the Atlantic coastal plain of Georgia can be found at Ft. Stewart military base near Savannah.[4]

***Litsea aestivalis*, pondspice**

Photo by Keith R. Tassin

The Altamaha basin, like most of the rest of the coastal plain, only has remnant patches of these eco-systems remaining. Rare plant species found in these pineland areas around the Altamaha River include savanna milkweed (*Asclepias pedicellata*), flat-woods ironweed (*Vernonia pulchella*), and the federally en-

Streams in the Altamaha River Watershed

The Nature Conservancy
OF GEORGIA
Saving the Last Great Places

dangered hairy rattleweed (*Baptisia arachnifera*), a plant found only in a 50-square-mile area in southeast Georgia.[5] Rare plant species found in the isolated wetlands in these flatlands include pondspice (*Litsea aestivalis*), corkwood (*Stillingia aquatica*), climbing heath (*Pieris phillyreifolia*), and spoon flower (*Peltandra sagittifolia*).

The uplands surrounding the upper part of the Altamaha River are naturally characterized by rolling hills dominated by longleaf pine–wiregrass communities. Sandstone rock outcroppings also occur throughout this area of the upper coastal plain.[6] Much of the land in this region has been converted to agriculture, but small pockets of remaining natural habitat are havens for biodiversity. The Nature Conservancy's Broxton Rocks Preserve occurs in this region.[7]

Rare plant species found in this portion of the Altamaha River basin include pineland Barbara's buttons (*Marshallia ramosa*), cutleaf harvest lice (*Agrimonia incisa*), creeping morning-glory (*Evolulus sericeus* var. *sericeus*), dissected beardtongue (*Penstemon dissectus*), and yellow coneflower (*Rudbeckia nitida*), among others.

Throughout the lower Altamaha River basin there are numerous blackwater tributaries which drain the surrounding uplands and empty into the river. The largest blackwater tributary is the Ohoopee River, which is famous for its dune-like sand ridges with their unique plant communities. Some of the other tributaries, which are much smaller, include Penholoway Creek, Beard's Creek, Goose Creek, Doctor's Creek, Tenmile Creek, Alex Creek, and Clayhole Creek. These small streams are typically forested by swamp tupelo, red maple, tuliptree, bald cypress, and various other hardwood species. Some of the rare and unique plant species found along these creeks include green-fly orchid (*Epidendrum conopseum*), fever-tree (*Pinckneya bracteata*), and Bartram's air-plant (*Tillandsia bartramii*).

The Altamaha River is one of the most ecologically significant areas remaining in the United States, if not the world. Over 50,000 acres of land have been protected around the river. Most of these lands are exceptional natural areas and are publicly owned. Areas like Big Hammock Natural Area and Griffin Ridge Wildlife Management Area offer easy access to some of the most unique natural plant communities that occur along the Altamaha River.

With continued conservation efforts the Altamaha has a fighting chance to remain one of our greatest natural resources and a biodiversity hotspot like no other. If John and William Bartram were to travel up the Altamaha today, many parts would appear as they did in the 1700s. Who knows, one day that vanishing *Franklinia* may even turn up!

Editor's note:

1. The 1996 issue of Tipularia contains an article about the travels of William Bartram in Georgia.
2. The November 1986 issue contains an article about searches for the lost Franklinia.
3. The Fall 1990 issue contains an article about bay forests.
4. The 1996 issue contains a report of a botanical survey of Fort Stewart conducted by The Nature Conservancy.
5. The May 1987 issue contains an article about the rare hairy rattleweed.
6. The Spring 1989 issue contains an article about the sandstone outcrops of the Altamaha Grit.
7. The 1998 issue contains an article about the bryophytes of Broxton Rocks.

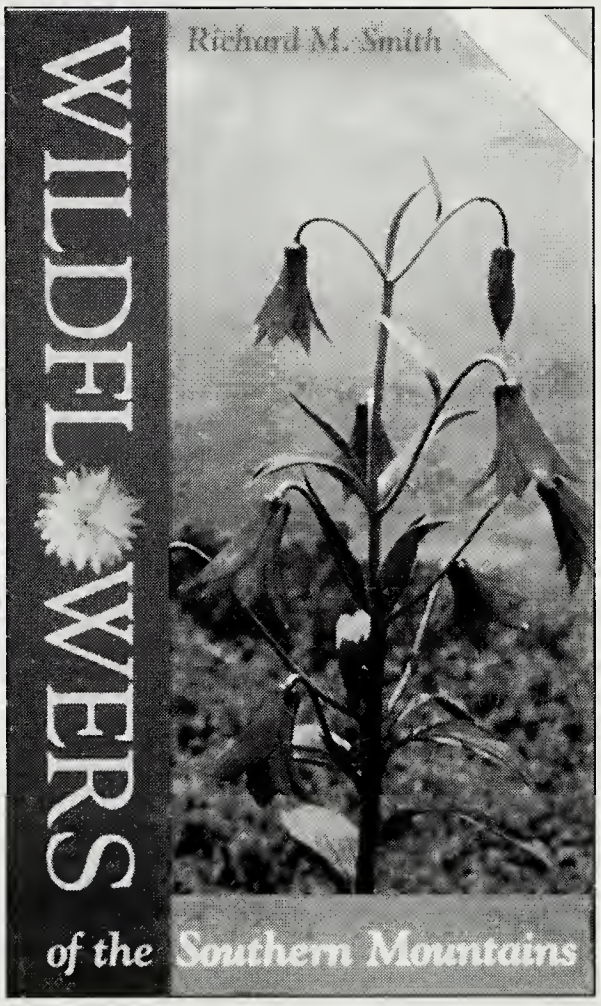
Bookshelf

Reviewed by Richard T. Ware, Sr.

Wildflowers of the Southern Mountains

by Richard M. Smith, 1998, The University of Tennessee Press, Knoxville, TN. Paperback, 262 pages, with 600 color photographs and line drawings by the author. $24.95

For those who refuse to use a technical manual, this is a must-have publication to carry on wildflower walks. And, for those who try to key their plants, this will be a beautiful addition to your library and a check to verify your identifications.



As indicated by a map on page ix, the southern mountains, as considered here, are "a complex that for the most part forms the eastern flank of the Southern Appalachians and includes the Blue Ridge and Great Smoky Mountains, but also extends in places into the Alleghenies and the Piedmont." The area covered includes western Maryland, Virginia, North and South Carolina, northern Georgia, the Blue Ridge in Alabama, eastern Tennessee, and West Virginia. Of course, this guide's usefulness will not be limited to this coverage area but will extend into the Ridge and Valley and Piedmont provinces, particularly to the north and east, and less so to the south and west.

In addition to the 600 taxa descriptions including color photos, there are also approximately 600 related taxa described in the text, making this a most comprehensive work. With a few exceptions, the plants that were excluded are the trees, shrubs, woody vines, grasses, sedges, rushes, submersed aquatics, and several groups of "weeds" that bear insignificant flowers.

A clear and concise introduction tells of some of the early botanical pioneers who explored these mountains, such as Mark Catesby, William Bartram, André Michaux, John Fraser, Frederick Pursh, and Thomas Nuttall. This part also describes the tremendous species diversity of the southern mountains and the current thinking as to why this is so, as well as the relationship between the southeastern U.S. flora and that of eastern temperate Asia.

A section called "What's in a name" reflects on the importance of knowing a plant's scientific name and the his-

tory of naming plants. This portion also talks about the origins of the treatment of illness using plants (medicine), and the Doctrine of Signatures.

In the main section of the book, which contains the descriptive text and photographs, the plants are arranged by families so that related genera may be considered together. Interspersed throughout the text, and differentiated from it, are short paragraphs which tell more about selected plants, such as how they got their common or scientific names, what the plants have been used for, and how rare certain species are. An attempt was made to hold technical terms to a minimum, and a glossary is provided for these.

Almost all of the pictures are in the good-to-excellent range, and I could find but one obvious error, a picture which was upside-down. The author evidently knew his plants well, as I saw no identification errors. It probably helped a great deal that the author was able to take his own photos.

One minor irritating point is that the text and pictures are in separate sections. This is done for economic reasons, and it seems that all new books are this way, but I would have paid a few dollars more to have the description and picture of the same plant together. Besides inconvenience, this led to a larger flaw: In the pictures section it doesn't reference what page a plant is on in the descriptions section. This forces you to thumb through the descriptions section looking for the plate number or the plant's name. This is not a big problem, however, and this book is highly recommended for those wishing to learn more about the flowers of the southern mountains.

The author was an experienced amateur botanist who worked with the National Park Service to create self-guided nature trails and served as President of the Western Carolina Botanical Club and as a director of the Asheville Botanical Gardens. He was the author of Wild Plants of America, published in 1989.

In "How to use this book" and "The fine print," the author explains how to use his pictorial key based on flower shape and color and gives some very helpful hints on identifying wildflowers. Anyone with an understanding of flower structure should be able to use his pictorial keys, but if you cannot, you can go riffling through the pages until you find a picture that matches, then read the description to confirm your diagnosis, since nearly half the species covered are illustrated.

Wildflowers of the Southern Mountains can be ordered from the University of Tennessee Press at **1-800-621-2736**. I purchased my copy at Fort Mountain State Park.

Editor's note: *Due to failing health, the author had to cancel plans to speak at the 1999 Georgia Botanical Society Spring Wildflower Pilgrimage. He died just one week before the Pilgrimage.*

The State Botanical Garden of Georgia

by Carol Nourse

The State Botanical Garden of Georgia has become one of the Southeast's premier gardens in the thirty years since it was first proposed. But in additon to being a beautiful place to enjoy flowers, plants, and landscaping, it has had a mission to serve as a teaching, research, and service institution since its very beginning.

HISTORY, BUILDINGS, AND GROUNDS

The Garden began in December, 1967, as an idea for a "living plant library" proposed to the University's Campus Planning and Improvement Committee by Dr. Francis E. Johnstone, Jr., a professor of horticulture at the University of Georgia. After the proposal received approval from President Fred Davison and the Board of Regents, a Botanical Garden Faculty Committee was appointed in March, 1968, to select a site, identify requirements, and prepare a budget and plan for financing.

The committee worked so speedily that by April 25 they had a "final proposal" for establishment of the Garden and had tentative approval for use of 293 acres of University-owned land in

South American Section in the International Garden at State Botanical Garden of Georgia

Photo from Hugh and Carol Nourse

Clarke County. The wooded site had approximately one mile of frontage on the Middle Oconee River and included three principal habitats of the Georgia piedmont: floodplain, slopes, and upland plateaus. (A fourth habitat, wetlands, was gained in the 1990 acquisition of 20 acres on the opposite side of the river in Oconee County. Since then, beaver activity has created some quasi-wetlands habitats on the Clarke County side.) In December, 1968, President Davison authorized Dr. Johnstone to begin development plans for the Botanical Garden "which will serve the teaching, research, and service areas of a broad cross section of our professional activities." Preliminary plans and sketches were used in a successful proposal to the Callaway Foundation, Inc., to provide funding for the headquarters building. Dr. Sam Jones and Dr. Wilbur Duncan, members of the Faculty Committee, presented recommendations on land use for the entire site.

The Garden quickly received interest and support from organizations around the state. The Georgia Nurserymen's Association was one of the first organizations to express its support. The Georgia Horticultural Society passed a resolution supporting development of the Garden and made fund-raising for it a major project. The Garden Club of Georgia, Inc., raised one dollar for each of its 21,000 members for support of plant collections representing the seven Garden Club districts. Among many other organizations that gave financial support in the early stages of development was the Georgia Botanical Society. Eventually, in 1972, the Friends of the Garden was chartered to coordinate the efforts of groups and individuals interested in supporting the Garden.

The first facilities for public use were three miles of trails laid out and cleared by the University's Physical Plant Grounds Department with the help of volunteers. According to Dr. Johnstone's *Short History of the State Botanical Garden*, "Coach Vince Dooley 'volunteered' two over-weight members of the football squad to help clear about a mile of tangled brush and vines along the White Trail. I understand the 'volunteers' made the team that fall!" In its very first year, the trail area was used by more than 1,500 students for field trips and minor research projects. In November of the following year, prior to the Georgia-Georgia Tech football game, Governor and Mrs. Jimmy Carter walked the trails accompanied by members of the Advisory Committee, the Botanical Garden Faculty Committee, The Garden Club of Georgia, Inc., and others. The Governor allocated $13,000 toward development of a master plan, and the favorable publicity didn't hurt a bit.

Conservatory at State Botanical Garden of GA

Photo from Hugh and Carol Nourse

Mrs. Carter returned to break ground for the Callaway Building in 1974. When it was completed in 1975, Dr. Johnstone, by then appointed Director of the Garden, and the staff were at last able to move to the Garden from their offices on campus.

In 1980, preliminary plans were drawn up for a combination visitor center and conservatory, also to be funded by the Callaway Foundation, Inc. This striking glass and steel structure, completed in 1984, contains offices, classrooms, the Garden Room Cafe, and a gift shop. But its most impressive feature is a 10,000-square-foot conservatory containing tropical and semi-tropical plants.

In 1984, the Garden was designated The State Botanical Garden of Georgia by the Georgia General Assembly. The new designation reflected the Garden's mission to serve the entire state and its appeal to visitors from all over Georgia and from other states and countries as well.

Silene regia, **royal catchfly**

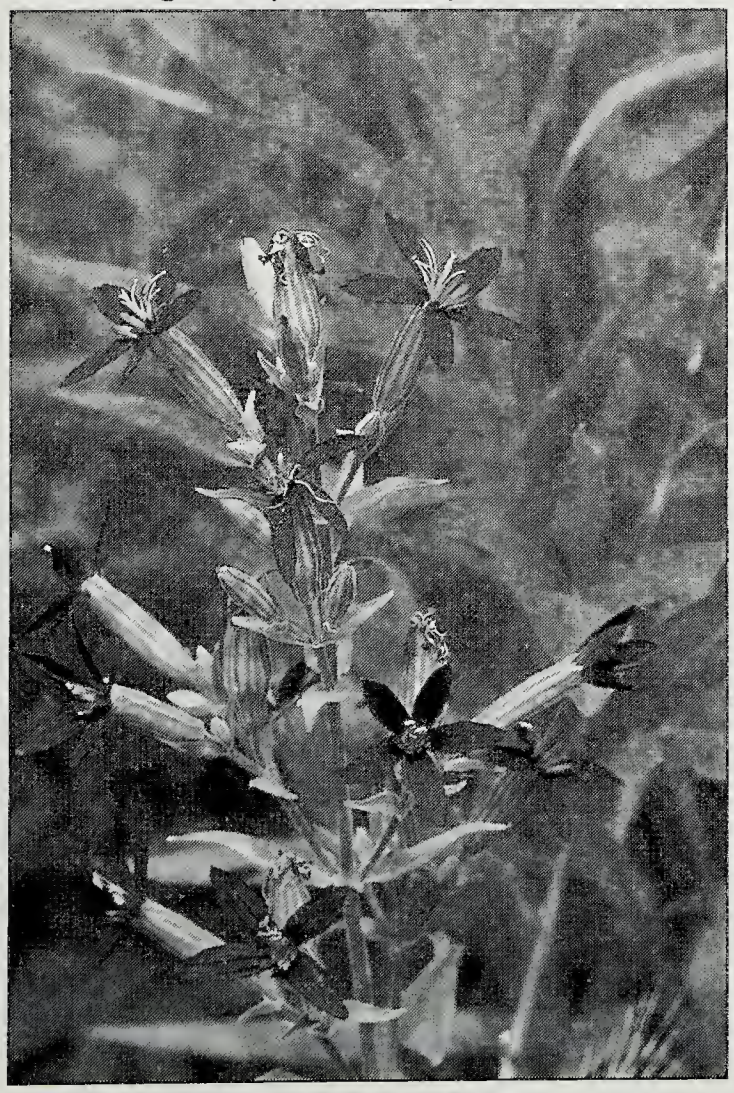


Photo from Hugh and Carol Nourse

The third major building is the Day Chapel, given by the family of Cecil B. Day, Sr., in his memory and completed in 1994. This popular site for weddings and receptions is constructed with cypress wood on both the exterior and interior. The magnificent carved mahogany and glass inner doors feature a live oak tree (the state tree) with Cherokee rose and dogwood blossoms. The rugs are hand-tufted with a design of dogwood blossoms, the state bird (brown thrasher), state butterfly (eastern yellow swallow-tail), and state flower (Cherokee rose). Except for special events, the building is open on a very limited schedule, but it is worth a walk down the path from the parking lot just to peek through the side windows.

The Garden Club of Georgia has recently moved into its new headquarters building, the fourth major building on the Garden site. It is located near the Visitor Center/Conservatory.

THE PLANTS

But plants are the heart of any garden. The State Botanical Garden of Georgia has many display beds, collections, and theme gardens. As befits a "living plant library," the collections emphasize a wide variety of representative species rather than spectacular masses of a few cultivars. For a first visit to the Garden, the Visitor Center is the place to begin. You can pick up a map of the gardens and trails and/or watch a ten-minute video overview of its attractions. Before heading outdoors, be sure to stroll through the two-level conservatory containing tropical and semi-tropical plants, particularly those of economic importance. Look for cinnamon, nutmeg, cola, cacao, coffee, papaya, and papyrus. A selection of the

Garden's 600 orchid cultivars is always on display.

Because the Garden contains such a variety of plants and habitats, each season has areas of special interest. In spring, the **Shade Garden** honoring the seven districts of the Garden Club of Georgia is at its best. A wisteria-covered arbor at the entrance is beautiful when in bloom. Sited on a steep hillside under a maturing hardwood forest, the garden features the plants for which the districts are named: azaleas, camellias, dogwoods, laurels, magnolias, redbuds, and viburnums. Native magnolias found here include the big leaf magnolia (*Magnolia macrophylla*), cucumber-tree (*M. acuminata*), mountain magnolia (*M. fraseri*), and sweetbay (*M. virginiana*). Shade-loving herbaceous plants include ferns, hostas, and hellebores. A gently sloping walkway with handrails makes the Shade Garden easily accessible.

Next to the Shade Garden is the **Dunson Native Flora Garden**. Its winding wood-chip paths lead past naturalized plantings of more than 300 species of southeastern natives, including some rare and threatened ones such as goldenseal (*Hydrastis canadensis*), ginseng (*Panax quinquefolia*), twinleaf (*Jeffersonia diphylla*), fringed campion (*Silene polypetala*), and stinking cedar (*Torreya taxifolia*). Spring is the time to find the woodland ephemerals in bloom here and many varieties of native ferns.

The adjacent **Fred C. Galle Study Collection** has examples of native azaleas: piedmont (*Rhododendron canescens*), flame (*R. calendulaceum*), pink shell (*R. vaseyi*), swamp (*R. viscosum*), and many more.

To find spring ephemerals in a wild setting, try the **Orange Trail**, which begins at the upper parking lot. It passes through a successional forest dominated by pines, then through ravines to a rocky stream. Along this stretch rue anemone (*Thalictrum thalictroides*) and liverleaf (*Hepatica americana*) bloom as early as January. They are followed by wild geranium (*Geranium maculatum*), bloodroot (*Sanguinaria canadensis*), Jack-in-the-pulpit (*Arisaema triphyllum*), and May-apple (*Podophyllum peltatum*). The trail continues past a beaverpond to the Oconee River floodplain. Here the **Purple Trail** provides an alternate return to the Visitor Center. An interpretive booklet describing the seven habitats found on this loop, and including a plant list, is available at the Visitor Center.

As spring turns to summer, the newest theme garden, the **International Garden** adjacent to the Visitor Center, puts out new growth and begins to bloom. A complex garden, it explores the relationship between plants and people throughout civilization. It is centered on a lawn bisected by a rocky stream that flows from a striking rock slab fountain on the wall of the Visitor Center, through a series of pools, under a flower-bordered bridge, and into

***Silene polypetala*, fringed campion**

Photo from Hugh and Carol Nourse

a lily pond, from which the water is recirculated.

The plants are grouped around the lawn into collections representative of three eras that have influenced the development of botanical gardens: the Middle Ages, the Age of Exploration, and the Age of Conservation.

The **Herb Garden and Physic Garden** present plants that were grown in the Middle Ages. Early physic gardens containing medicinal plants were associated with medical schools and led to the development of botanical gardens. Laid out as an elaborate knot garden, a garden design dating from the 17th century, this one contains pennyroyal (*Mentha pulegium*), hyssop (*Hyssopus officinalis*), horehound (*Marrubium vulgare*), and comfrey (*Symphytum officinale*), among other plants. Strolling along the brick walkways of the Herb Garden, you can see (and smell!) herbs that would have been used for seasonings, dyes, fragrances, and ceremonial purposes.

During the **Age of Exploration**, people explored the world searching for new and valuable plants and established many botanical gardens to preserve and propagate them. Collections here represent plants found in the Mediterranean and Middle East, Spanish America, the American South, and the Orient and China. The **Ernest Henry "Chinese" Wilson Collection** honors a botanist whose sometimes harrowing expeditions to China introduced more than a thousand species of Oriental plants, including the widely used Kurume azaleas, to the western world. Many of those from Southeast China are well adapted to the similar climate of the Southeastern United States. The **Bartram Collection** contains plants found by John and William Bartram on their travels through the American South. Some of the trees included are American holly (*Ilex opaca*), fringe-tree (*Chionanthus virginicus*), Georgia oak (*Quercus georgiana*), and bald cypress (*Taxodium distichum*).

The current era is the **Age of Conservation**, when the survival of plant species is of great concern. A **bog gar-**

***Ilex decidua*, possumhaw**

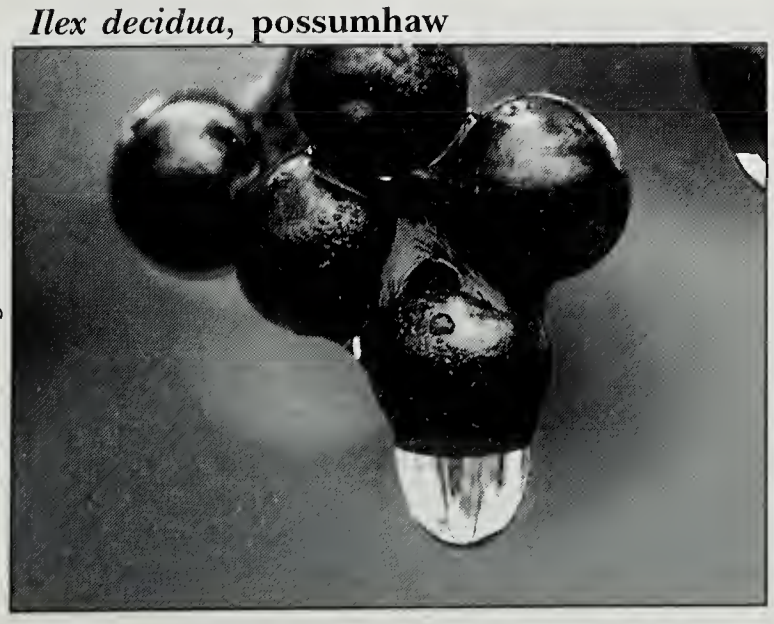


Photo from Hugh and Carol Nourse

Herb Garden in the International Garden

Photo from Hugh and Carol Nourse

den contains pitcherplants (*Sarracenia* spp.) and associated wetland plants such as sundews (*Drosera* spp.), yellow-eyed grass (*Xyris* spp.), and Coosa Barbara's buttons (*Marshallia mohrii*). The **Threatened and Endangered Plants** area features state or federally protected plants. Found here are the Atlantic white cedar (*Chamaecyparis thyoides*), Ocmulgee scullcap (*Scutellaria ocmulgee*), pale purple coneflower (*Echinacea laevigata*), and royal catchfly (*Silene regia*). The **American Indian Plants** section contains plants used by the Indians of the Southeast.

The **Rose Garden** was one of the first gardens developed at The State Botanical Garden. Flowering from May through September, it displays all major classes of roses, particularly varieties most appropriate for Georgia gardens. A gazebo covered with Georgia's state flower, the Cherokee rose (*Rosa laevigata*), is in full bloom for a short period about the first week in May.

The **Annual/Perennial Garden** is a bright splash of color on a summer day. It has a traditional perennial border that has changed and evolved, as good perennial borders should. Hybrid daylilies, irises, artemisias, ornamental grasses, and red hot poker are among plants found here. The **All-America Selections Display Garden** presents recent AAS award winners, while the **Dahlia Garden** contains representatives of most classes and colors of dahlias. In the same area is a collection of flowers attractive to butterflies and hummingbirds and a children's garden with such kid-attractors as giant sunflowers, gourds, pumpkins, and creative scarecrows.

Many of the plants continue to bloom through autumn, but by October fall foliage and colorful berries begin to dominate. The **Trial Garden**, where trees and shrubs are evaluated for adaptation to the Southeast, contains a collection of cultivars of decidu-

Spigelia gentianoides, gentian pink

Photo from Hugh and Carol Nourse

Rose Garden in the International Garden

Photo from Hugh and Carol Nourse

ous hollies (*Ilex decidua* and *I. verticillata*) that are covered with berries in shades of red, orange, or yellow. A group of sweetspire (*Itea virginica*) turns a lovely maroon shade. In the Shade Garden and at the entrance to the Visitor Center, leaves of Japanese maples (*Acer palmatum*) are vibrant crimson. On the wooded slopes along the five miles of nature trails, oaks, hickories, dogwoods, black gums, and red maples add their color to the scene.

The nature trails are a good choice even in winter, on its milder days. One can practice winter tree identification, look for beaver-gnawed stumps near the beaver pond, and enjoy more open vistas along the Middle Oconee River. In December, the Visitor Center contains seasonal decorations and displays of poinsettias and other holiday plants. In the Conservatory area, many of the orchids are in bloom, along with holiday cactuses (*Schlumbergera* spp.). The beds in front of the Visitor Center are filled with pansies, or perhaps some ornamental kales, to provide winter color. If you are lucky enough to arrive after a snowfall, look for striking shapes and patterns in the Herb and Physic Gardens.

Throughout the year, and unseen by most visitors, the garden carries out major programs in research and education. Both are centered on plant conservation. Plants currently under study include gentian pink (*Spigelia gentianoides*), smooth purple coneflower (*Echinacea laevigata*), purple pitcher plant (*Sarracenia purpurea*), and Georgia plume (*Elliotia racemosa*). Medicinal plants are another major research area.

Education takes place at all levels, from puppet shows about endangered plants for elementary grades to bog garden projects on school sites, teachers' training in native plant propagation, gardening symposiums and

Knot Garden in the snow

Photo from Hugh and Carol Nourse

Annual/Perennial Garden

Photo from Hugh and Carol Nourse

master gardener classes for adults, and internships for students in plant sciences.

The State Botanical Garden of Georgia is truly a garden for all seasons and for all of Georgia.

SOURCES

Johnstone, Francis E., Jr., 1993, A short history of The State Botanical Garden of Georgia, The State Botanical Garden of Georgia.

Lewis, A. Jefferson, III, undated, Brief history of State Botanical Garden, typescript.

Lewis, A. Jefferson, III, 1996, Garden guide, The State Botanical Garden of Georgia.

Shenk, Anne, Elaine Nash and Ann Mathews, 1998, The plant communities along the purple/orange trail at The State Botanical Garden of Georgia, The State Botanical Garden of Georgia.

The Garden is located in Athens, on South Milledge Avenue. Coming from Atlanta on Highway 316, turn right onto the South Bypass. At the second exit, turn right onto South Milledge Ave. The Garden entrance is on the right approximately one mile south of the Bypass.

The grounds are open daily from 8 A.M. to sunset. The Visitor Center hours are from 9 A.M. to 4:30 P.M. Monday through Saturday and 11:30 A.M. to 4:30 P.M. on Sunday. There is currently no admission fee.

For futher information call (706) 542-1244 or write to: The State Botanical Garden of Georgia, 2450 S. Milledge Ave., Athens, GA 30605.

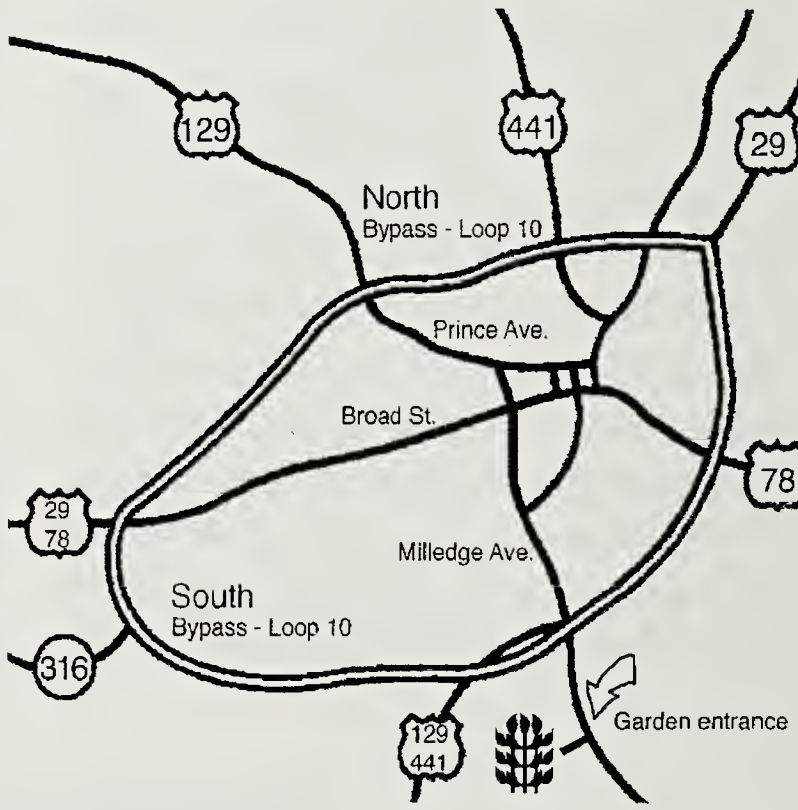


Photo from Hugh and Carol Nourse

International Garden at the State Botanical Garden of GA

New York Botanical Garden Library
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Byliners continued

Carol Schneier, Ph.D., board member of the Georgia Botanical Society, is an enthusiastic volunteer on a variety of natural history projects. Field studies include tree censuses, dinosaur digs, archeology excavations, marine research voyages, bird banding, and underwater archeology.

Alberta Smith, M.S.W., grew up with an appreciation for the native wildflowers growing on the bluffs near her hometown in Minnesota. In Ely, she and her husband, Paul, began to explore and photograph the northern Minnesota bogs with their mysterious carnivorous plants and intriguing orchids. The Smiths moved to Athens, Georgia, in 1979, and Albie now focuses on Georgia's plant heritage. She is the current Field Trip Chairperson for the Georgia Botanical Society.

Keith Tassin has a B.S. in biology and has worked for The Nature Conservancy in Georgia since 1993 as a botanist for the Altamaha River Project. In addition to botany, his interests include scuba diving, kayaking, camping, and running.

Richard T. Ware, Sr., is President of the Georgia Botanical Society and has written for both Tipularia and BotSoc News. Although he originally focused on trees, his interests have expanded to include all higher plants, particularly those of Floyd County.

Watercolor paintings by Gail Arnott Carr

Trillium rugelii, southern nodding trillium

NEW YORK
BOTANICAL GARDEN

Cypripedium acaule, pink lady's-slipper

Tipularia

A Publication of The Georgia Botanical Society 1999